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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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CESARI AND MCKENNA, LLP 88 BLACK FALCON AVENUE BOSTON, MA 02210			EXAMINER SAVLA, ARPAN P	
			ART UNIT 2185	PAPER NUMBER
			MAIL DATE 07/02/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/772,822

Applicant(s)

RAJAN ET AL.

Examiner

Arpan P. Savla

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 17 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 16-18, 21 and 22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15, 19 and 20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### **Response to Amendment**

This Office action is in response to Applicant's communication filed April 17, 2007 in response to the Office action dated October 6, 2006. Claim 3 has been amended. Claims 16-18 have been withdrawn. New claims 21-22 have been added. Claims 1-22 are pending in this application. Claims 1-15 and 19-22 remain in consideration for this application.

### **Request for Interview**

On June 11, 2007 the Examiner left a voice message at the number provided in Applicant's last correspondence in an effort to schedule a telephonic interview as requested by Applicant. However, the Examiner's message was never returned and subsequently no telephonic interview was had before the issuance of this Office action.

### **Election/Restrictions**

Newly submitted claims 21-22 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: New claims 21-22 are directed to the same subject matter as non-elected claims 16-18, that being generating a particular pattern of data blocks, classified in class 711, subclass 217.

Since Applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 21-22 are withdrawn from consideration

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as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

## **OBJECTIONS**

### **Claims**

1. In view of Applicant's amendment, the objection to **claim 3** is withdrawn.

## **REJECTIONS BASED ON PRIOR ART**

### **Claim Rejections - 35 USC § 103**

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. **Claims 1-15 and 19-20** are rejected under 35 U.S.C. 103(a) as being obvious over Haskin et al. (U.S. Patent Application Publication 2003/0158863) in view of Wang-Knop et al. (U.S. Patent 6,571,261).

4. **As per claim 1**, Haskin discloses a method for separating data blocks referenced by a writeable virtual disk (vdisk) from data blocks referenced only by a backing store of a system, the method comprising the steps of:

loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a

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valid pointer to a data block or an invalid pointer representing a hole (paragraph 0053; paragraph 0063; Fig. 2B);

loading blocks of the backing store from a disk into memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block (paragraph 0053; paragraph 0095; Fig. 8D); *It should be noted that the "snapshot data set" is analogous to the "backing store."*

replacing each field having a hole in the writable vdisk indirect block with a new pointer to the data block referenced by the corresponding backing indirect field (paragraph 0081). *It should be noted that "updating" the original file system creates "holes" (i.e. invalid pointers) which are replaced by providing "ditto disk addresses" within the snapshot dataset.*

Haskin does not expressly disclose searching each field of the writable vdisk indirect block for a hole.

Wang-Knop discloses searching each field of the writable vdisk indirect block for a hole (col 7, lines 10-53; Figs. 5 and 6).

Haskin and Wang-Knop are analogous art because they are from the same field of endeavor, that being file systems, and even more specifically file system maintenance.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to implement Wang-Knop's defragmentation utility within Haskin's file system snapshot.

The motivation for doing so would have been to provide a defragmentation utility that works online, avoids locking data structures for long periods of time, is memory efficient, uses sub-blocks for fragment analysis and migration, as well as minimizes data movements (Wang-Knop, col. 3, lines 23-27).

Therefore, it would have been obvious to combine Haskin and Wang-Knop for the benefit of obtaining the invention as specified in claim 1.

5. **As per claim 2**, the combination of Haskin/Wang-Knop discloses the step of replacing comprises the step of:

dirtying the data block pointed to by the backing store indirect block to enable write allocation of the dirty data block without altering a data content of the data block (Haskin, paragraph 0079). *It should be noted that replacing the address of the allocated block is in effect "dirtying" the block without altering the content.*

6. **As per claim 3**, the combination of Haskin/Wang-Knop discloses the step of replacing further comprises the step of:

choosing a new pointer for a newly allocated data block containing the unaltered data content (Haskin, paragraph 0081); *It should be noted that the "ditto disk address" acts as the "new pointer" for the newly allocated indirect block.*

setting bits in block allocation structures for the newly allocated data block (Haskin, paragraph 0058). *It should be noted that the "block allocation map" is analogous to the "block allocation structures."*

placing the new pointer to the newly allocated data block into the field of the writable vdisk indirect block to replace the hole (Haskin, paragraph 0081). *It should be noted that "storing" is analogous to "placing."*

7. **As per claim 4**, the combination of Haskin/Wang-Knop discloses freeing the dirty data block (Haskin, paragraph 0177); *It should be noted that "deleting" is analogous to "freeing."*

writing the newly allocated data block to disk (Haskin, paragraph 0177). *It should be noted that "flushing disk access buffers to disk" is analogous to "writing to disk."*

8. **As per claim 5**, the combination of Haskin/Wang-Knop discloses releasing an association of the writable vdisk to the backing store to thereby separate the writable disk data blocks from the backing store data blocks (Haskin, paragraph 0112). *It should be noted that by "deleting" the snapshot it follows that all associations with the original file system are "released."*

9. **As per claim 6**, the combination of Haskin/Wang-Knop discloses the pointers contained in the writable vdisk indirect block fields and the backing store indirect block fields comprise logical block numbers (VBNs) (Haskin, paragraph 0096).

10. **As per claim 7**, the combination of Haskin/Wang-Knop discloses the invalid pointers contained in the writable vdisk indirect block fields comprise a zero logical volume block number (VBN) (Haskin, paragraph 0072). *It should be noted that "null"*

*values for the disk addresses indicate unallocated blocks, thus, it follows that unallocated blocks have invalid pointers.*

11. **As per claim 8**, the combination of Haskin/Wang-Knop discloses the plurality of fields in the writable vdisk indirect block are a writable vdisk level 1 buffer and the plurality of fields in the backing store indirect block are a backing store level 1 buffer (Haskin, paragraph 0055). *It should be noted that the "inodes" function as "level 1 buffers."*

12. **As per claim 9**, Haskin discloses an apparatus for separating data blocks referenced by a writeable virtual disk (vdisk) from data blocks referenced only by a backing store of a system, the apparatus, comprising:

a backdoor message handler adapted to load blocks of the writable vdisk and backing store from disk into the storage system (paragraph 0053); *It should be noted that Haskin's "computer processing device" (paragraph 0050) functions as a "backdoor message handler."*

a writable vdisk indirect block in memory having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a hole (paragraph 0063; Fig. 2B).

a backing store indirect block in the memory having a plurality of fields, each backing store indirect block field corresponding to a field of the writable vdisk indirect block, each backing store indirect block field having a pointer to a data block (paragraph 0095; Fig. 8D); *See citation note for the similar limitation in claim 1 above.*



a write allocator for replacing each field representing a hole in the writable vdisk indirect block with a new pointer to the data referenced by the corresponding backing store indirect block field (paragraph 0081). *It should be noted that Haskin's "computer processing device" functions as a "write allocator." Also, see the citation note for the similar limitation in claim 1 above.*

Haskin does not expressly disclose a special loading function for searching each field of the writable vdisk indirect block for one or more fields representing a hole.

Wang-Knop discloses a special loading function for searching each field of the writable vdisk indirect block for one or more fields representing a hole (col 7, lines 10-53; Figs. 5 and 6). *It should be noted that Wang-Knop's "defragmentation utility" functions as a "special loading function."*

Haskin and Wang-Knop are analogous art because they are from the same field of endeavor, that being file systems, and even more specifically file system maintenance.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to implement Wang-Knop's defragmentation utility within Haskin's file system snapshot.

The motivation for doing so would have been to provide a defragmentation utility that works online, avoids locking data structures for long periods of time, is memory efficient, uses sub-blocks for fragment analysis and migration, as well as minimizes data movements (Wang-Knop, col. 3, lines 23-27).

Therefore, it would have been obvious to combine Haskin and Wang-Knop for the benefit of obtaining the invention as specified in claim 9.

13. **As per claim 10**, the combination of Haskin/Wang-Knop discloses the write allocator is further adapted to:

choose a new pointer for a newly allocated data block containing an unaltered data content (Haskin, paragraph 0081), set bits in block allocation structures for the newly allocated data block (Haskin, paragraph 0058), and place the new pointer to the newly allocated data block into the field of the writable vdisk indirect block to replace the hole (Haskin, paragraph 0081). *See the citation notes for claim 3 above.*

14. **As per claim 11**, the combination of Haskin/Wang-Knop discloses the write allocator is further adapted to:

free the dirty data block and write the newly allocated data block to disk (Haskin, paragraph 0177). *See the citation notes for claim 4 above.*

15. **As per claim 12**, the combination of Haskin/Wang-Knop discloses the backdoor handler loads blocks of writable vdisk and the blocks of the backing store during periods of reduced processing activity (Haskin, paragraph 0053). *It should be noted that the blocks are loaded during periods other than when the blocks are being updated, thus when compared to periods of block updating, the loading periods have reduced processing activity.*

16. **As per claim 13**, the combination of Haskin/Wang-Knop discloses the pointers contained in the writable vdisk indirect block fields and the backing store indirect block fields comprise logical block numbers (VBNs) (Haskin, paragraph 0096).

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17. **As per claim 14**, the combination of Haskin/Wang-Knop discloses the invalid pointers contained in the writable vdisk indirect block fields comprise a zero logical volume block number (VBN) (Haskin, paragraph 0072). *See the citation note for claim 7 above.*

18. **As per claim 15**, the combination of Haskin/Wang-Knop discloses the plurality of fields in the writable vdisk indirect block are a writable vdisk level 1 buffer and the plurality of fields in the backing store indirect block are a backing store level 1 buffer (Haskin, paragraph 0055). *See the citation note for claim 8 above.*

19. **As per claim 19**, Haskin discloses an apparatus for separating data blocks referenced by a writeable virtual disk (vdisk) from data blocks referenced only by a backing store of a system, comprising:

means for loading blocks of the writable vdisk from a disk into a memory, the loaded blocks including a writable vdisk indirect block having a plurality of fields, each field storing a valid pointer to a data block or an invalid pointer representing a hole (paragraph 0053; paragraph 0063; Fig. 2B); *See the citation notes for the similar limitations in claims 1 and 9.*

means for loading blocks of the backing store from a disk into memory, the loaded blocks including a backing store indirect block having a plurality of fields, each backing store indirect field corresponding to a field of the writable vdisk indirect block, one or more backing store indirect block fields having a pointer to a data block (paragraph 0053; paragraph 0095; Fig. 8D); *See the citation notes for the similar limitation in claims 1 and 9.*

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means for replacing each field having a hole in the writable vdisk indirect block with a new pointer to the data block referenced by the corresponding backing indirect field (paragraph 0081). *See the citation notes for the similar limitation in claims 1 and 9.*

Haskin does not expressly disclose means for searching each field of the writable vdisk indirect block for a hole.

Wang-Knop discloses means for searching each field of the writable vdisk indirect block for a hole (col 7, lines 10-53; Figs. 5 and 6). *See the citation notes for the similar limitation in claims 1 and 9.*

Haskin and Wang-Knop are analogous art because they are from the same field of endeavor, that being file systems, and even more specifically file system maintenance.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to implement Wang-Knop's defragmentation utility within Haskin's file system snapshot.

The motivation for doing so would have been to provide a defragmentation utility that works online, avoids locking data structures for long periods of time, is memory efficient, uses sub-blocks for fragment analysis and migration, as well as minimizes data movements (Wang-Knop, col. 3, lines 23-27).

Therefore, it would have been obvious to combine Haskin and Wang-Knop for the benefit of obtaining the invention as specified in claim 19.

20. **As per claim 20**, the claim is rejected for the same reasons as cited in claim 1 above combined with Haskin's disclosure of a computer readable medium, including program instructions executing on a computer (Haskin, paragraph 0206-207).

**Response to Arguments**

21. Applicant's arguments filed April 17, 2007 with respect to **claims 1-15 and 19-20** have been fully considered but they are not persuasive.

22. With respect to Applicant's arguments in the first and second full paragraphs on page 10 of the communication filed April 17, 2007, the Examiner respectfully disagrees and directs Applicant to the rejection of claim 1 above. The Examiner submits that the cited portion of Haskins discloses filling indirect blocks of the file having null values (i.e. replacing holes) with ditto disk addresses (i.e. new pointers) in the data snapshot set (i.e. backing store). Accordingly, Haskins sufficiently discloses replacing each field having a hole in the writable vdisk indirect block with a new pointer to the data block referenced by the corresponding backing indirect field and therefore Haskins does not teach away from the instant invention.

23. With respect to Applicant's argument in the first full paragraph on page 11 of the communication filed April 17, 2007, the Examiner respectfully disagrees and directs Applicant to the rejection of claim 1 above. As detailed in section 22 of the Office action directly above, paragraph 0081 of Haskins sufficiently discloses replacing each field having a hole in the writable vdisk indirect block with a new pointer to the data block referenced by the corresponding backing indirect field.

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24. With respect to Applicant's argument that in the second full paragraph on page 11 of the communication filed April 17, 2007, the Examiner respectfully disagrees and directs Applicant to the rejection of claim 1 above. As stated in the rejection, Haskin and Wang-Knop are analogous art because they are from the same field of endeavor, that being file systems, and even more specifically file system maintenance. In both Haskins and Wang-Knop logical block address (LBA) pointers to physical memory become invalid due to updating and modification of files. These invalid LBA pointers apply to both fragmentation of the virtual address space as well as indirect blocks of the file having null values.

25. With respect to Applicant's argument that in the third full paragraph on page 11 of the communication filed April 17, 2007, the Examiner respectfully disagrees. Even in a system using shadow inodes to manage of chain of snapshots performing defragmentation would be beneficial, not opposing, because reading and writing of files would be faster due to the fact that portions of the file are stored more closely together on physical memory.

26. As for Applicant's arguments with respect to claims 2-15 and 19-20, the arguments rely on the allegation that the independent claim 1 is allowable and therefore for the same reasons claims 2-15 and 19-20 are allowable. However, as addressed above, the independent claim 1 is not allowable, thus, Applicant's arguments with respect to claims 2-15 and 19-20 are not persuasive.

**Conclusion**

**STATUS OF CLAIMS IN THE APPLICATION**

The following is a summary of the treatment and status of all claims in the application as recommended by MPEP 707.70(i):

**CLAIMS REJECTED IN THE APPLICATION**

Per the instant office action, **claims 1-15 and 19-20** have received a second action on the merits and are subject of a second action final.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

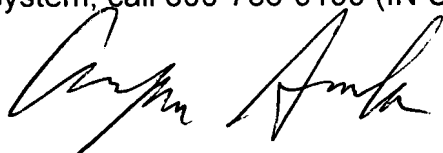
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arpan P. Savla whose telephone number is (571) 272-1077. The examiner can normally be reached on M-F 8:30-5:00.

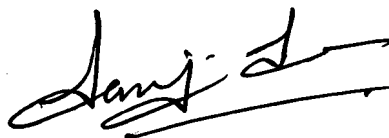
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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sanjiv Shah can be reached on (571) 272-4098. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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June 24, 2007



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